# Near-Zero Gravity Cryogenic Line Chilldown Experiment in a Suborbital Reusable Launch Vehicle

## Problem Statement

The main objective is to build an accurate line chilldown data base from the proposed experiment under an actual space microgravity condition with a duration long enough to cover the complete chilldown characteristics of a fluid transfer line or other hydraulic components. The actual space near-zero gravity tests will be complementary to the NASA GRC-led Cryogenic Propellant Storage and Transfer (CPST) Project and space industry.

## Technology Development Team


- PI: Jacob N Chung, Department of Mechanical and Aerospace Engineering, University of Florida, email : jnchung@ufl.edu.


- Funding Support : NASA KSC NASA GRC and UF College of Engineering.


- David J. Chato and, Jason W. Hartwig (NASA GRC), Wesley L. Johnson and Rudy Werlink (NASA KSC), Peter Wilson (ULA LLC).


## Proposed Flight Experiment

### Experiment Readiness:

The payload will be ready by March 1, 2012 allowing us plenty of time to integrate it to the flight platform.

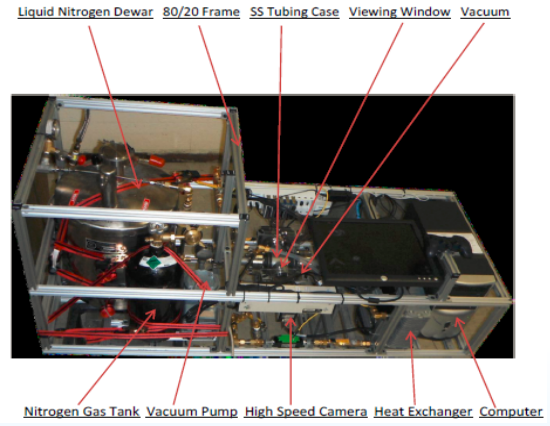
### Test Vehicles:

The payload can only be accommodated by the Virgin Galactic Space Ship Two due the weight and size requirement.

### Test Environment:

The proposed payload was flown twice in parabolic, reduced gravity flight experiment conducted at Johnson Space Center on July 14th to 15th, 2011 and Jun 14$^{th}$ to 15$^{th}$ 2012.

### Test Apparatus Description:




## Technology Maturation

The technology before the proposed sRLV experiment is at TRL 4. The system has been tested for short durations first in drop towers (~2s) and then on parabolic flights (~30s). The next step is to test in a long enough duration to accomplish a complete chilldown process (which has been done with this system on the ground) in space microgravity or a free fall environment. Testing the line chilldown component for a full chilldown using cryogenic propellants in space microgravity will advance the technology to TRL 5.

## Objective of Proposed Experiment

The microgravity chilldown methodologies and engineering models that will be developed from the data base of the proposed project are expected to have direct applications and benefits to both NASA and industry in their research and development on cryogenic storage and transfer systems for future space exploration missions.

**TA 01 Launch Propulsion Systems, TA 02 In-Space Propulsion Systems, and TA 07 Human Exploration Destination Systems**